woods of northern Minnesota, particularly in the Rainy River country. These have been years of abundance of the snowshoe rabbit also. The latter have been so numerous that they did great damage by girdling small trees, and the quantity of brush they ate off was simply amazing. As one of our rangers put it, "The rabbits in my district have eaten up the brush this winter, and if they increase any more they'll probably start logging next year." The rabbits are rapidly dying off in certain districts this year.

Ordinarily the black fox is a larger and stronger individual than his red brother. This in itself may have significance.

Is it unreasonable to assume, in view of the foregoing facts, that a plenteous supply of the food most palatable to the red fox has some influence at least in strengthening the tendency of this animal to produce dark-colored specimens, in other words to cause melanism?

It is true that some of the increase in the proportion of dark foxes may be due, and probably is due, to the coming in of dark specimens from more northern localities in Canada, following up the abundant mouse and rabbit crop. No locality, even in any of the adjoining portions of Canada, however, has a much higher relative proportion of silver foxes than is ordinarily found along the Rainy River.

In view of the farming experiments now under way with dark foxes, I should welcome a discussion of this point, which is coming to have economic importance.

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SCIENTIFIC BOOKS

Igneous Rocks. By Joseph P. Iddings. Vol. II., Description and Occurrence. New York, John Wiley & Sons. 1913. 8vo. Pp. xi + 685, 20 figures and maps.

The first volume of Iddings's treatise on igneous rocks, dealing in the abstract with their composition, texture, mode of occurrence, origin and classification, appeared in 1909 and was reviewed in Science, Vol. XXX., pp. 408–411, 1909. The work is now complete with this second volume, which presents a systematic description of the rocks and a review of their known distribution and association in all parts of the world. This volume is of the greatest importance to petrographers, for in no other work in any language is there such an extensive and judicial analysis of the vast literature of petrography. Iddings has succeeded wonderfully in his difficult task, but it is clear that the time is rapidly approaching when each of the great subjects, systematic description, mode of occurrence and world distribution, of igneous rocks, must be fully treated by itself, unrestricted by the limitations of a general work.

The markedly original features of Iddings's book make it unusually desirable that the reader should familiarize himself with the author's purpose and plan which are outlined in the preface. From this statement it may be well to quote certain passages, as follows:

"Since the fundamental need of petrology at this time is a correct understanding of the constitution or composition of igneous rocks it has been the purpose of this treatise to emphasize the chemical and mineral characteristics in their description. For this reason chemical analyses of rocks, transformed into possible mineral compounds, have been made the foundation on which the systematic description of igneous rocks has been constructed; that is, they have been employed as a basis of definition and of correlation of rocks that differ in texture and to a greater or less extent in apparent or actual mineral composition. Igneous rocks have been treated as though they were portions of *continuous series of mixtures* of mineral compounds varying in numerous ways, and not as specific though somewhat ill-defined compounds possessing individual entities to be reckoned with in their grouping or classification" (page iii).

"The purpose of the second part of the book has been to present a brief sketch of the distribution of igneous rocks throughout the earth so far as now known, in order to lay the foundation for a study of possible petrographical provinces in different regions, since much investigation of these rocks in all re-

gions is needed before definite conclusions may be reached regarding the actual nature of such provinces and *their significance with respect to the dynamical history of the earth*" (page v).

Part I. of the volume, devoted to the systematic description of igneous rocks, is introduced by an important review of their characters and the difficulties attending their systematic treatment. It is pointed out that the rock type "is subjective, inherent in the petrographer, not the rock." Igneous rocks form a continuous series, hence their systematic treatment must be arbitrary as to divisions, but it does not follow that all methods of classification are equally good or bad.

One of the most important features of Iddings's work is the influence it seems destined to have on the development of systematic petrography. That the user of the book may fully appreciate this it seems desirable to survey the present situation of the science, on lines not especially emphasized by the author.

The current system of petrography, called the qualitative system by Iddings, classifies igneous rocks chiefly by their important mineral constituents. For granular rocks there is more and more effort to recognize the quantitative development of certain minerals, while nephelite, leucite and others are given great weight, almost regardless of their abundance. In porphyritic rocks, however, especially if micro-, crypto- or hypocrystalline, the phenocrysts alone are given classificatory value in many cases (Rosenbusch system). The groundmass is practically ignored by many petrographers in naming rocks.

The fundamental importance of chemical composition of igneous rocks is universally recognized. Mineral composition is an expression of the chemical, though less directly than once supposed. The natural ambition of the petrographer to express chemical composition in his mineralogical classification is frustrated by the fact that he can not ascertain the mineral composition of many rocks at all accurately and by the variable chemical composition of most rock-making minerals. Only the inherent and perhaps insuperable difficulties of the problem have prevented the formulation, before now, of a satisfactory mineralogical classification, and it is equally certain that efforts to improve that system will go on with at least some measure of success.

The quantitative system, of which Iddings is one of the authors, permits an accurate classification of igneous rocks, desirable for many purposes, wherever the chemical composition can be ascertained. It is self-evident, however, that the data for the quantitative classification of the vast majority of rocks can not be obtained and that another system of general applicability must be used concurrently with it. The most evident and familiar character-giving feature of igneous rocks is their mineral composition, and it seems clear that some improved form of the current system must always remain the one for general purposes. But to satisfy the natural demands of scientific men this system must be given much greater precision and consistency than it now possesses. The approach to a real system must come by introducing greater precision in definition, using quantitative mineral composition as far as practicable and expressing in the most feasible manner a correlation between chemical and mineral factors. The petrographic system of the future for general purposes will be an evolution from the unsatisfactory one now current through the trying out of many propositions and a selection of the best.

A quantitative factor is now being introduced into the mineralogical system in various ways. Monzonite, granodiorite and other major terms illustrate this, and a large number of new rock names of lesser importance have been recently proposed in recognition of the abundance or prominence of certain minerals. But this development is not controlled or guided by definite rules or principles, and until such have been adopted increased confusion must be the result.

Probably all petrographers are ready to welcome a practical and logical proposition to modify or control the mineralogical classification by chemical data. But it is evident that the application of such a scheme implies chem-

ical analysis of a rock which is to be classified or else an ability on the part of the petrographer to make a satisfactory comparison between the rock in hand and a similar type which has been analyzed. The proper use of such a system will be beyond the powers of many who now essay to name rocks. Probably some petrographers will object to Iddings's propositions as impossible of application by many who now endeavor to use the current system. But increasing precision in the system in any direction must have the same effect in some degree, and the development of petrography can not long be held back for the sake of a simplicity which can be maintained only at the expense of accuracy and efficiency.

Chemical data can be logically applied to the development of the mineralogical system only on the basis of our knowledge of the relation between chemical and mineral composition afforded by the several thousand rocks of which good analyses are now available. This relation has been studied by means of the significant molecular ratios between silica and bases or between various bases or groups. Osann's work is preeminent in this direction. His ratios and triangular diagrams on which they may be plotted express clearly certain chemical characteristics of igneous rock groups. But the application of such data to the revision of systematic mineralogical classification is a very complex problem the solution of which has not been attempted as yet.

Another means of expressing relations between chemical and mineral composition is the norm of the quantitative system, and Iddings's book will always be cited in the literature of systematic petrography as notable for its well-thought-out and far-reaching plan to reconstruct the qualitative or mineralogical system on the same principles which underlie the quantitative classification. If it is practicable to develop the mineralogical system on these principles, this is a first, long step forward in its evolution, to be followed by many other improvements suggested by experience. The reviewer's opinion as to the success of this attempt is naturally subject to the charge of prejudice, hence he contents himself in pointing out the great importance of Iddings's systematic propositions, whether they are finally adopted or not. They deserve the most careful, unbiased attention of petrographers in any case. If it proves to be practicable to develop the mineralogical system in the way proposed, it will then be brought into desirable harmonious relations with the quantitative system.

In Volume I. of "Igneous Rocks" Iddings presented his modification of the "Qualitative Mineralogical Classification" in the usual tabular form. A quantitative element is made prominent here by establishing five major divisions based on the dominance of I., quartz; II., quartz and feldspar; III., feldspar; IV., feldspar and lenads; V., lenads. The character of the dominant feldspar and the abundance or subordinate part of the ferromagnesian minerals gave subdivisions of the larger ones. While the lines of this scheme were not made precise, they served to divide many rock groups or varieties of current usage.

The underlying idea in this scheme is clear, but the detail with which it is worked out in Volume II. suggests an evolution in the author's mind. For instance, the ultra-basic rocks were not separated as a distinct group in Volume I., but now they appear as Division 6, and the way in which factors of the quantitative system are applied to give precision to the new scheme is illustrated by the statement that Division 6 embraces the rocks of Classes IV. and V. of the quantitative system. Iddings's first systematic division is actually by the amount of normative salic and femic molecules, into two groups, one corresponding to Classes I., II. and III., and the other to Classes IV. and V., of the quantitative system.

Divisions 1–5 are bounded by sharp lines determined by normative quartz, feldspar and lenads, the same relation by which orders are formed in Classes I., II. and III. in the quantitative system. The relative amount of mafic (ferromagnesian) and felsic minerals is used to make two subdivisions in each of these five major divisions.

The feldspathic rocks of divisions 2, 3 and 4 are each divided into three groups by the rela-

tive importance of the alkali and lime-soda feldspars. For aphanitic and glassy rocks this is determined from the norms, from which the average composition of the lime-soda feldspar can be calculated. Distinctions between potash and soda-rocks are also made.

The granular or phaneritic rocks are treated on the assumption that in most cases their mineral composition can be approximately determined. The aphanitic and glassy rocks which are chemical equivalents of the phanerites are classed with them, and their equivalence is determined through the norms. The limits of divisions in the quantitative system being vague, Iddings has assigned boundaries by quantitative factors which are the same as or similar to some of those used in the quantitative system. This involves restricting and redefining of many current terms, but where an old group name, such as andesite, is in question, Iddings has proposed new names for certain new divisions of the larger and older group.

While most of the names in current use are retained, Iddings gives precision to many of them, and supplements them by many new ones. As he has been guided by definite principles, several of which are new in their application to mineralogical systems, Iddings has practically made a new petrographic system. The reviewer believes that a large proportion of the new propositions will be welcomed by most petrographers of wide acquaintance with igneous rocks as corresponding, at least approximately, to changes in the old system which they have long regarded as necessary.

The way in which Iddings has subdivided older groups and supplied new terms may be illustrated by a few examples. Three kinds of dacite are recognized, each characterized by its average or normative plagioclase. Oligoclase dacites are called *ungaite;* those with andesine are called *shastaite,* and those with labradorite, *bandaite.* Oligoclase andesite is distinguished from andesite proper as *kohalaite,* while andesine basalt is called *hawaiite,* as distinct from basalts of labradorite feldspar.

A very valuable feature of the book is the 71 tables of chemical analyses of rocks (nearly 1,100 in all) arranged to show the composition of the new systematic divisions. The norm and quantitative classification of each rock are also given, and a general correlation of the mineralogical and quantitative systems is clearly expressed by the tables. Many diagrams also serve to show the relations of the two systems.

Part II. of this volume is a review of what is known concerning the occurrence and distribution of igneous rocks. It is based on personal examination of the extensive literature cited, and the magnitude of the task of preparation for this discussion will be appreciated only by those who have made some similar study of original sources. This is not a theoretical discussion of petrographical provinces, but an attempt to present the facts of our present very imperfect knowledge of the geographical distribution of igneous rocks. It is significant that Iddings, after this review, concludes that "it is too soon to attempt to define the area of any petrographical province. The data are insufficient for a complete definition or description of any one province . . ." (p. 351).

The distribution of rocks is presented by means of maps of continental areas and a systematic review of the rocks described from various districts.

The discussion begins with the rocks of North America as they occur in large provinces. Following the geographical treatment is a preliminary discussion of petrographic provinces suggested and a description of their individual characteristics, illustrated by diagrams.

The chemical composition of rocks of certain areas is shown by 65 tables containing 1,260 analyses, giving norms, etc., as in tables of the systematic part.

WHITMAN CROSS

Allen's Commercial Organic Analysis. Vol. VIII. Fourth edition. Edited by W. A. DAVIS and SAMUEL S. SADTLER. Philadelphia, P. Blakiston's Son & Co. 1913. Pp. x + 696. Price, $5.00 net.

Allen's "Commercial Organic Analysis," in